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AMENDMENTS TO THE DRAWINGS:

The attached sheet of drawings includes changes to Figure 3. This sheet, which includes Figure 3, replaces the original sheet including Figure 3. In Figure 3, the origin for the graph has been corrected.

Attachment:

Replacement Sheet

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REMARKS

Claims 1-4, 7-8, 11-14, 16-26, 29-32, and 34-37 are all the claims presently pending in the application. The specification, drawings, and claims 3 and 18 are amended to more clearly define the invention and claims 5-6, 9-10, 15, 27-28, and 33 are canceled. Claims 1 and 16 are independent.

These amendments are made only to more particularly point out the invention for the Examiner and not for narrowing the scope of the claims or for any reason related to a statutory requirement for patentability.

Applicants also note that, notwithstanding any claim amendments herein or later during prosecution, Applicants' intent is to encompass equivalents of all claim elements.

Entry of this §1.116 Amendment is proper. Since the Amendments above narrow the issues for appeal and since such features and their distinctions over the prior art of record were discussed earlier, such amendments do not raise a new issue requiring a further search and/or consideration by the Examiner. As such, entry of this Amendment is believed proper and Applicant earnestly solicits entry. No new matter has been added.

Claims 1-2, 10-12, 15-19, 28-30, and 33-37 stand rejected under 35 U.S.C. § 102(b) as being anticipated by the Gall reference. Claims 1-2, 7-8, 10-12, 16-19, 25-26, 28-30, and 34-37 stand rejected under 35 U.S.C. § 102(b) as being anticipated by the Laster reference. Claims 1-2, 4, 7-8, 11-12, 16-17, 19, 21-26, 28-30, and 34-37 stand rejected under 35 U.S.C. § 102(b) as being anticipated by the Ostrovsky et al. reference. Claims 1-2, 7, 9-11, 16-17, 19, 25, 27-29, and 34-37 stand rejected under 35 U.S.C. § 102(b) as being anticipated by the Laughlin reference. Claims 3, 9, 13-14, 20, 27, and 31-32 stand rejected under 35 U.S.C. § 103(a) as being anticipated by the Ostrovsky et al. reference.

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These rejections are respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

A first exemplary embodiment of the claimed invention, as defined by, for example, independent claim 1, is directed to a cross joint that includes a cross shaft member, rolling members and bearing cups. The cross shaft member includes four shafts each having a neck portion and a race portion, and shoulder portions between adjacent neck portions. The rolling members are adapted to rotate on the race portions and the bearing cups are fitted to the respective shafts via the rolling members. The race portions and the shoulder portions are subjected to roller burnishing for increasing a hardness of each surface of the race portions and the shoulder portions and for increasing a residual compressive stress immediately below each of the surfaces.

A second exemplary embodiment of the claimed invention, as defined by, for example, independent claim 16, is directed to a cross joint that includes a cross shaft, at least one roller on a race and a bearing cup. The cross shaft includes a plurality of shafts each having a neck and a race, and at least one roller burnished shoulder between two of the necks. The bearing cup is fitted to one of the plurality of shafts via the at least one roller.

Conventional cross joints have experienced fatigue breaking or bending fatigue at the shoulder area between the shaft neck areas because of the large bending stress experienced during operation.

In stark contrast to the conventional cross joints, the present invention provides a roller burnished shoulder between the necks of the shafts. In this manner, the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders can

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be increased and, therefore, the life of the cross joint is extended. (Page 15, lines 2-13).

II. THE EXAMINER'S RESPONSE TO ARGUMENTS

Examiner Binda points out that independent claims 1 and 16 are product-by-process claims in that the structure of the claimed product is defined by the process that produced the product.

Examiner Binda also points out that the patentability of the product does not depend upon its method of production.

However, Applicants respectfully submit that it is the structure that is provided by the process of making the claimed cross joint for which Applicants seek protection.

“The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. See, e.g., *In re Garnero*, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979) (holding “interbonded by interfusion” to limit structure of the claimed composite and noting that terms such as “welded,” “intermixed,” “ground in place,” “press fitted,” and “etched” are capable of construction as structural limitations.)” M.P.E.P. § 2113.

In this particular instance, the claims recite a “roller burnished shoulder,” and, as explained above, the fact that the shoulder is “roller burnished” imparts “distinctive structural characteristics” (M.P.E.P. § 2113) to the shoulder which increases the fatigue strength of the

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shoulder, the hardness of the surface of should, and the residual compressive stress of the shoulder. These “distinctive structural characteristics” (M.P.E.P. § 2113) provide distinct advantages over conventional cross joints because they increase the service life of the cross joint.

Therefore, Applicants respectfully submit that “distinctive structural characteristics” which are imparted to the shoulders due to the fact that the shoulders are “roller burnished” are not taught or suggested by the applied references and Applicants respectfully request withdrawal of the applied art rejections and allowance of the present application.

III. THE 35 U.S.C. § 112 REJECTIONS

The Office Action rejects claims 3, 13-14, 18, 20, and 31-32 under 35 U.S.C. § 112, first paragraph and claim 18 under 35 U.S.C. § 112, second paragraph. While Applicant submits that such would be clear to one of ordinary skill in the art to allow them to know the metes and bounds of the invention, taking the present Application as a whole, to speed prosecution claim 18 has been amended in accordance with Examiner Binda’s very helpful suggestions.

With respect to claims 3 and 18, the Examiner alleges that “Fig. 3 shows the residual stress at a depth of 0.3 mm is approximately 800 Mpa. No more. No less.” Applicants respectfully direct the Examiner’s attention to the specification at, for example, page 11, lines 9-10, which explains that “a residual compressive stress equal to or larger than 800 Mpa is generated at a depth of at least 0.3 mm from the surface.” This Amendment amends claims 3 and 18 to more closely correspond to the specification.

Further, with respect to claims 13-14, 20, and 31-32, the Office Action alleges that

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“only the race portions 2c are disclosed with the features in this claim. See page 8, line 23 through page 9, line 8.”

Contrary to the Examiner's allegation, the specification provides very clear support for the subject matter recited by claims 13-14, 20, and 31-32 in the specification at, for example, page 4, line 23 through page 5, line 14 and page 8, lines 18-19. The specification explains at page 4, line 23 through page 5, line 14 that “by subjecting the race portion and the shoulder portion of the cross shaft to roller burnishing, the hardness of surfaces of the race portion and the shoulder portion can be increased and residual compressive stress immediately below the surface can be increased. . . . the fatigue strength of the race portion and the shoulder portion can further be effectively increased.” (Emphasis added).

The specification also very clearly explains at page 8, lines 18-19 that “the race portions 2c and 4a and the shoulder portion 2d are subjected to roller burnishing (deep rolling) after the finishing.” (Emphasis added).

Applicants refer the Examiner to page 11, line 17 through page 15, line 13 for multiple, additional descriptions where the specification makes it very clear that not only the race portion but also the shoulder portions are roller burnished.

While applicants note that the specification at, for example, page 8, line 20 to page 9, line 1, provides a description of the distinctive structural characteristics that are imparted by the roller burnishing to the race portion, these descriptions are merely exemplary and that the roller burnishing of the shoulder portions impart similarly distinctive structural characteristics to the shoulder portions.

In view of the foregoing, the Examiner is respectfully requested to withdraw these rejections.

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IV. THE PRIOR ART REJECTIONS

A. The Gall reference rejection

Regarding the rejection of claims 1-2, 10-12, 15-19, 28-30 and 33-37, the Examiner continues to allege that the Gall reference teaches the claimed invention. Applicants submits, however, that there are elements of the claimed invention which are neither taught nor suggested by the Gall reference.

As explained previously, the Gall reference does not teach or suggest the features of the claimed invention including: 1) shoulder portions that are subjected to roller burnishing (claim 1); and 2) a roller burnished shoulder (claim 16). This feature is important for extending the life of the cross joint by increasing the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders by roller burnishing the shoulder.

The Gall reference discloses that a heat treatment is performed after roller burnishing and, thus, a hardness of each of the surfaces of the race portions and the shoulder portions and the residual compressive stress immediately below these surfaces are not increased.

Indeed, the Gall reference actually teaches away from performing a heat treatment before roller burnishing because it would be difficult to form the grooves by plastic deformation.

In particular, the Gall reference discloses a cross joint which includes trunnions (shafts) which are grooved to provide alternately spaced lands 30 and grooves 32 for providing improved oil retention (page 2, lines 3-7). The Gall reference further discloses roll burnishing the shafts to create a projection 29 on either side of the groove 32 which slightly overlaps the bottom 27 of the groove (Fig. 5, page 2, lines 22-27). Therefore, the Gall reference only discloses roll burnishing the shafts and does not teach or suggest a roller

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burnished shoulder.

Indeed, the Examiner does not allege that the Gall reference discloses shoulder portions that are subjected to roller burnishing as recited by the independent claims.

Therefore, the Gall reference does not teach or suggest each and every element of the claimed invention and the Examiner is respectfully requested to withdraw this rejection of claims 1-2, 10-12, 15-19, 28-30 and 33-37.

B. The Laster reference rejection

Regarding the rejection of claims 1-2, 7-8, 10-12, 16-19, 25-26, 28-30 and 34-37, the Examiner continues to allege that the Laster reference teaches the claimed invention. Applicants submit, however, that there are elements of the claimed invention which are neither taught nor suggested by the Laster reference.

In particular, as explained before, the Laster reference does not teach or suggest the features of the claimed invention including: 1) shoulder portions that are subjected to roller burnishing for increasing a hardness of each surface of the race portions and the shoulder portions and for increasing a residual compressive stress immediately below each of the surfaces (claim 1); and 2) a roller burnished shoulder (claim 16). As explained above, this feature is important for extending the life of the cross joint by increasing the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders by roller burnishing the shoulder.

The Laster reference discloses an induction heating tool 58 that heats the surfaces of the races 55 and 56 (col. 2, lines 59-63). Therefore, for the same reason explained above with respect to the Gall reference, the Laster reference does not disclose increasing a hardness of

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each of the surfaces of the race portions and the shoulder portions and increasing the residual compressive stress immediately below these surfaces.

Rather, the Laster reference only discloses burnishing the "inner and outer races 55 and 56" of the cross joint (col. 2, lines 57-59 and col. 3, lines 30-31).

Indeed, the Laster reference does not mention doing anything at all to the shoulders, let alone roller burnishing the shoulders.

Further, the Examiner does not allege that the Laster reference teaches doing anything at all to the shoulders, let alone roller burnishing the shoulders.

Therefore, the Laster reference does not teach or suggest each and every element of the claimed invention and the Examiner is respectfully requested to withdraw this rejection of claims 1-2, 7-8, 10-12, 16-19, 25-26, 28-30 and 34-37.

C. The Ostrovsky et al. reference rejection

Regarding the rejections of claims 1-3, 4, 7-9, 11-14, 16-17, 19-31, and 34-37, the Examiner alleges that the Ostrovsky et al. reference teaches and/or renders the claimed invention unpatentable. Applicants continue to submit, however, that there are elements of the claimed invention which are neither taught nor suggested by the Ostrovsky et al. reference.

As explained previously, the Ostrovsky et al. reference does not teach or suggest the features of the claimed invention including: 1) shoulder portions that are subjected to roller burnishing (claim 1); and 2) a roller burnished shoulder (claim 16). As explained above, this feature is important for extending the life of the cross joint by increasing the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders by roller

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burnishing the shoulder.

Indeed, the Ostrovsky et al. reference does not mention anything at all that is even remotely related to roller burnishing, let alone roller burnishing a shoulder.

Further, the Ostrovsky et al. reference actually teaches away from roller burnishing the shoulder.

As is clearly explained by the specification of the present application, roller burnishing tends to increase the hardness of a material. Therefore the present invention increases the hardness of the shoulder area of the cross joint by roller burnishing the shoulder.

In stark contrast, the Ostrovsky et al. reference specifically explains that "the sections near the base of the cross arm must have a higher resistance to static and impact bending. Therefore, the hardness of these sections must be lower in order to reduce brittleness." (Emphasis added, col. 1, lines 25-29; col. 2, lines 31-40).

In other words, the Ostrovsky et al. reference actually teaches away from roller burnishing the shoulder because roller burnishing increases the hardness of the shoulder and the Ostrovsky et al. reference specifically teaches that the shoulder hardness "must be lower."

Further, the Examiner does not allege that the the Ostrovsky et al. reference mentions anything at all that is even remotely related to roller burnishing, let alone roller burnishing a shoulder.

Therefore, the Ostrovsky et al. reference clearly does not teach or suggest each and every element of the claimed invention and the Examiner is respectfully requested to withdraw these rejections of claims 1-3, 4, 7-9, 11-14, 16-17, 19-31, and 34-37.

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D. The Laughlin reference rejection

Regarding the rejection of claims 1-2, 7, 9-11, 16-17, 19, 25, 27-29, and 34-37, the Examiner continues to allege that the Laughlin reference teaches the claimed invention. Applicants submit, however, that there are elements of the claimed invention which are neither taught nor suggested by the Laughlin reference.

Just like all of the other applied references, the Laughlin reference does not teach or suggest the features of the claimed invention including: 1) shoulder portions that are subjected to roller burnishing for increasing a hardness of each surface of the race portions and the shoulder portions and for increasing a residual compressive stress immediately below each of the surfaces (claim 1); and 2) a roller burnished shoulder (claim 16). As explained above, this feature is important for extending the life of the cross joint by increasing the fatigue strength, the hardness of the surface, and the residual compressive stress of the shoulders by roller burnishing the shoulder.

The Laughlin reference discloses a universal joint which provides a "particularly efficient fluid-tight joint at the outer end of each of the trunnion pins so that light or thin commercial oil may be used to lubricate the moving parts of the joint without leakage." (Col. 1, lines 5-10).

The Laughlin reference does not mention doing anything at all to the shoulders, let alone roller burnishing the shoulders.

Further, the Examiner does not allege that the Laughlin reference teaches doing anything at all to the shoulders, let alone roller burnishing the shoulders.

Therefore, the Laughlin reference does not teach or suggest each and every element of the claimed invention and the Examiner is respectfully requested to withdraw this rejection of

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claims 1-2, 7, 9-11, 16-17, 19, 25, 27-29, and 34-37.

V. FORMAL MATTERS AND CONCLUSION

The Office Action objects to the drawings. This Amendment encloses a replacement drawing sheet which corrects Figure 3 so that the values along the y-axis increases with the distance from the origin. Applicants respectfully request withdrawal of this objection.

In view of the foregoing amendments and remarks, Applicants respectfully submit that claims 1-4, 7-8, 11-14, 16-26, 29-32, and 34-37, all the claims presently pending in the Application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

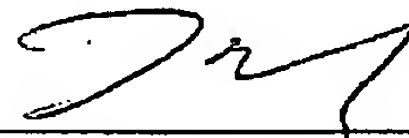
Should the Examiner find the Application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

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The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 7/28/05

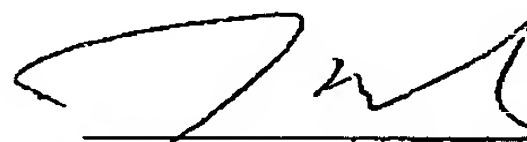
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FACSIMILE TRANSMISSION

I hereby certify that I am filing this Amendment Under 37 CFR §1.116 by facsimile, to Examiner Gregory John Binda, Group Art Unit 3679, at fax number (571) 273-8300, on this 22nd day of July, 2005.

Respectfully Submitted,

Date: 7/22/05

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Art Unit No.: 3679
Annotated Sheet Showing Changes

FIG. 3

